EMERGENCY ACTION PLAN

FLOWER CREEK DAM

COPY NO. 4

MORRISON MAIERLE, INC.

An Employee-Owned Company

EMERGENCY ACTION PLAN

FLOWER CREEK DAM

MT-1458

OWNER:

CITY OF LIBBY
P.O. BOX 1428
LIBBY, MONTANA 59923
PHONE: (406) 293 - 2731

ORIGINAL DATE: MAY 1995

REVISIONS:

June 2000
June 2002
June 2004
April 2006
April 25, 2007
September 28, 2009

COPY NO. 3

PREPARED BY:

MORRISON-MAIERLE INC.
910 HELENA AVENUE
P.O. BOX 6147
HELENA, MT 59604
PHONE: (406) 442 - 3050

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TABLE 1: IMMEDIATE NOTIFICATION LIST

If Flower Creek Dam is failing or failure seems imminent, call:

Lincoln County Sheriff	911 or 293-4112 (From out of county)
Vic White Lincoln County DES	293-2729 home 293-1129 cell 293-6295
Dan Thede, City of Libby Public Works Director	293-2731 office 293-4782 home 293-1213 cell
	OR
Walter McElmurry	293-2067 Office 293-1203 Cell 293-9147 Home

1 INTRODUCTION

1.1 Purpose

The purpose of this emergency action plan (EAP) is to safeguard the lives and to reduce property damage of the citizens of the City of Libby, living along Flower Creek. In the event of a failure of Flower Creek Dam, residents living along Flower Creek should be notified.

1.2 Description of Flower Creek Dam

Flower Creek Dam is located in Lincoln County, Section 21, Township 30 North, Range 31 West as shown on Figure 1. The dam is located 3.5 miles southwest of Libby and is owned by the City of Libby, P.O. Box 1428, Libby, Montana 59923. It is used as a municipal water supply. Technical data pertaining to Flower Creek Dam is listed in Appendix C.

1.3 Access to Dam

Flower Creek Dam is accessed by driving South (towards Kalispell) from the Libby city center on Highway 2 to Shaughnessy Road. Turn right on Shaughnessy Road and proceed up the hill for approximately 3/4 mile until reaching the intersection of Cabinet Heights Road. Veer left on Cabinet Heights Road and continue South for approximately 1/2 mile until reaching the intersection of Granite Creek Road (USFS Road 618). Turn right on Granite Creek Road and proceed approximately 3/4 mile until reaching the intersection of Flower Creek Road (USFS 128). Turn right on Flower Creek Road and proceed approximately 1 1/2 miles to a pullout next to a City of Libby access gate. Park your vehicle at the gate and hike about 100 yards down the access road to Flower Creek Dam.

1.4 Hazard Area

The evacuation area would extend downstream along the following Flower Creek stream reaches.

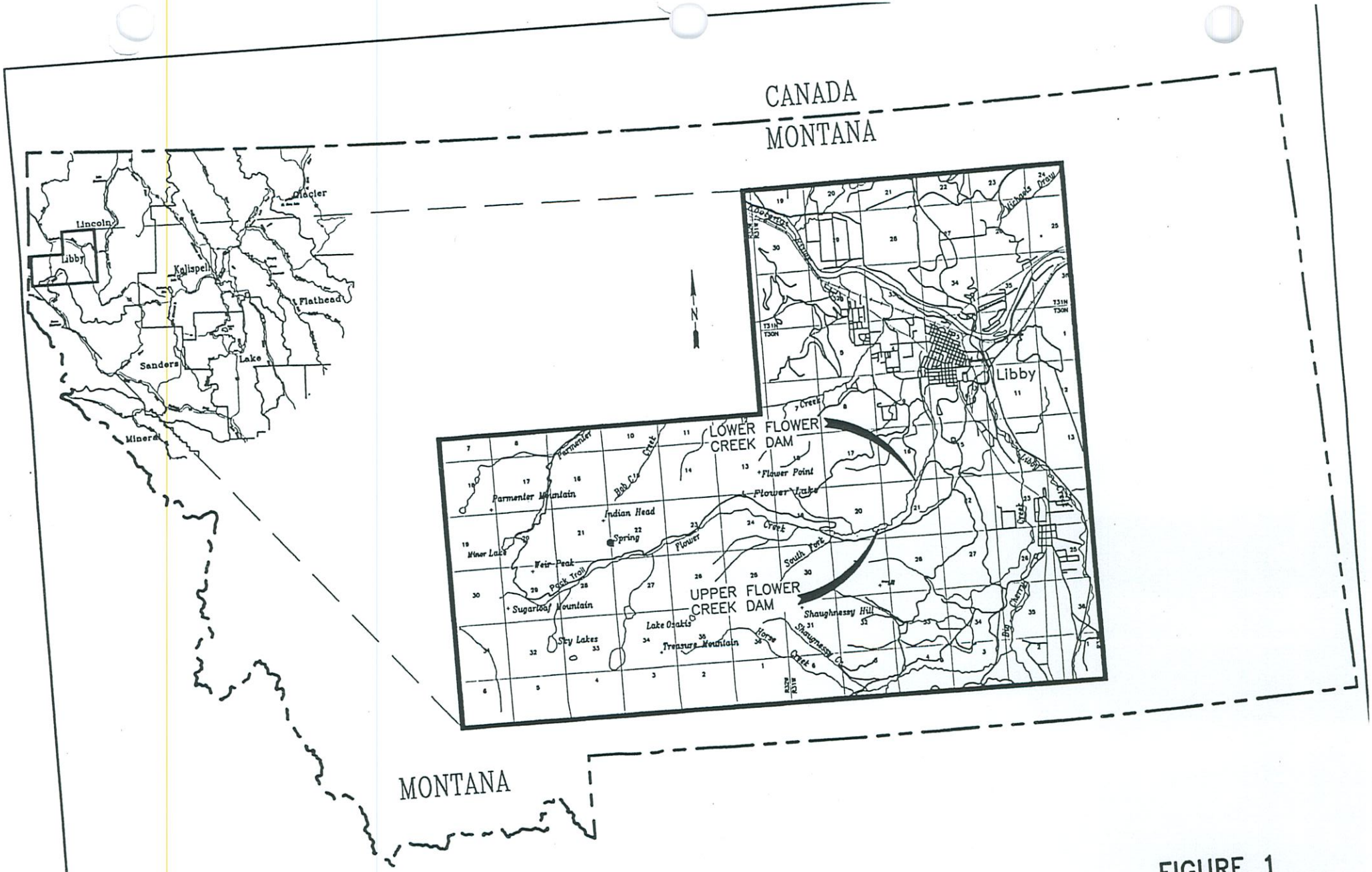


FIGURE 1
VICINITY MAP

Reach 1: Flower Creek Dam to Lower Flower Creek Diversion Dam.

Reach 2: Lower Flower Creek Diversion Dam to the City of Libby corporate limits.

Reach 3: City of Libby corporate limits to the Kootenai River.

The characteristics of the dambreak flooding are shown on Table 2.

TABLE 2: DAMBREAK FLOOD CHARACTERISTICS

RVR MILE FROM DAM	MAX FLOW (CFS)	MAX DEPTH (FT)	TIME FLOOD (MIN)	DESCRIPTION
.00	70,000	34	1	Flower Creek Dam
.50	61,000	15	4	1/2 Mile Downstream of Flower Creek Dam
.99	54,000	14	6	1 Mile Downstream of Flower Creek Dam
1.59	46,000	13	10	Near Upstream End of Diversion Dam
2.25	42,000	13	15	2 1/4 Mile Downstream of Flower Creek Dam
2.65	39,000	13	16	2 1/2 Mile Downstream of Flower Creek Dam
3.38	28,000	4 TO 5	24	Near Spruce Street
3.55	27,000	4 TO 5	28	Near 10th Street
3.81	25,000	4 TO 5	35	Near 5th Street
4.60	25,000	4 TO 5	72	Kootenai River

1.5 Responsibility and Authority

Pursuant to the State of Montana Dam Safety Act, Chapter 15 of Title 85, the dam owner is responsible for production, coordination, maintenance, and implementation of this emergency action plan. Extent of owner implementation was defined through coordination of this plan with the Lincoln County sheriff and disaster and emergency services personnel.

1.6 Periodic Review and Updating

This document requires periodic review and updating. Each copy should be kept current and the distribution list is shown on Table 2. The owner will review and update this EAP on at least a yearly basis and distribute the revisions to each copy shown on the distribution list. Review and update by a professional engineer will be accomplished as required by the dam's operation permit, but no less than every five years.

TABLE 3: EAP OFFICIAL DISTRIBUTION LIST

Location	Copy #
City of Libby Water Treatment Plant	1
City of Libby Office	2
DNRC Dam Safety Section	3
Morrison-Maierle Inc.	4
Lincoln County Sheriff	5
Lincoln County EMA	6

2 NOTIFICATION PROCEDURES

2.1 Failure is Imminent or Has Occurred

If Flower Creek Dam is failing, two things must be undertaken immediately: (1) the hazard areas downstream from the dam must be evacuated, and (2) any steps that might save the dam or reduce damage to the dam or hazard area should be taken. Refer to the maps in Appendix B to determine the areas that are likely to be inundated if the dam fails. The evacuation will be handled according to the county warning plan.

2.2 What the Dam Owner Should Do

As dam owner, it is your responsibility to:

A. Call the Sheriff's Dispatch Center 911 and Disaster and Emergency Management Agency 293-6295 / 6526 (office and home). Be sure to say, "This is an emergency". They will call other authorities and the media and begin the evacuation.

B. Do whatever is necessary to bring anyone in immediate danger (someone on the dam, or directly below the dam, or evacuees if directed by the sheriff) to safety.

C. Keep in frequent touch with Emergency Management Agency. They will tell you how to handle the emergency.

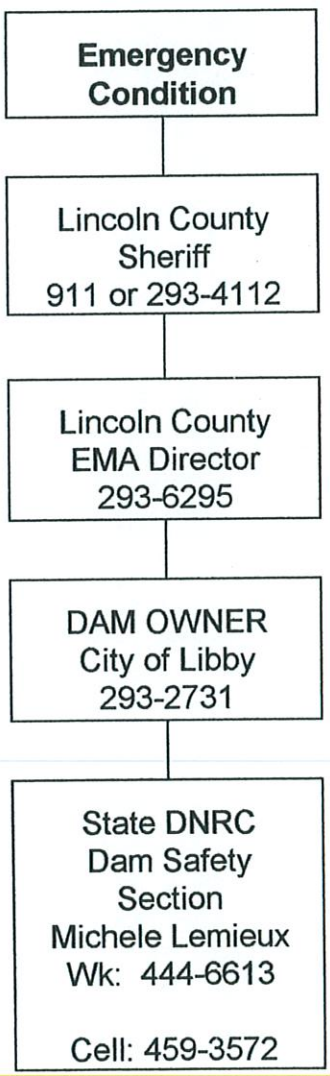
D. If all means of communication are lost: (1) try to find out why, (2) try to get to another radio or telephone that works, or (3) get someone else to try to reestablish communications. If these means fail, then handle the immediate problems as well as you can and periodically try to reestablish contact with Emergency Management Agency.

E. It is important that you accurately judge whether the dam is about to fail. If you aren't sure whether the dam is threatened, seek advice from a qualified engineer or call the Department of Natural Resources and Conservation Dam Safety Section.

2.3 Potentially Hazardous Situation is Developing

A potentially hazardous situation is an event or condition not normally encountered in the routine operation of the dam and reservoir. Among the unusual occurrences that may affect the dam are the dam's structural integrity, failure of the spillway or outlet works, heavy precipitation or rapid spring snowmelt,

FIGURE 2: IMMINENT FAILURE NOTIFICATION FLOWCHART

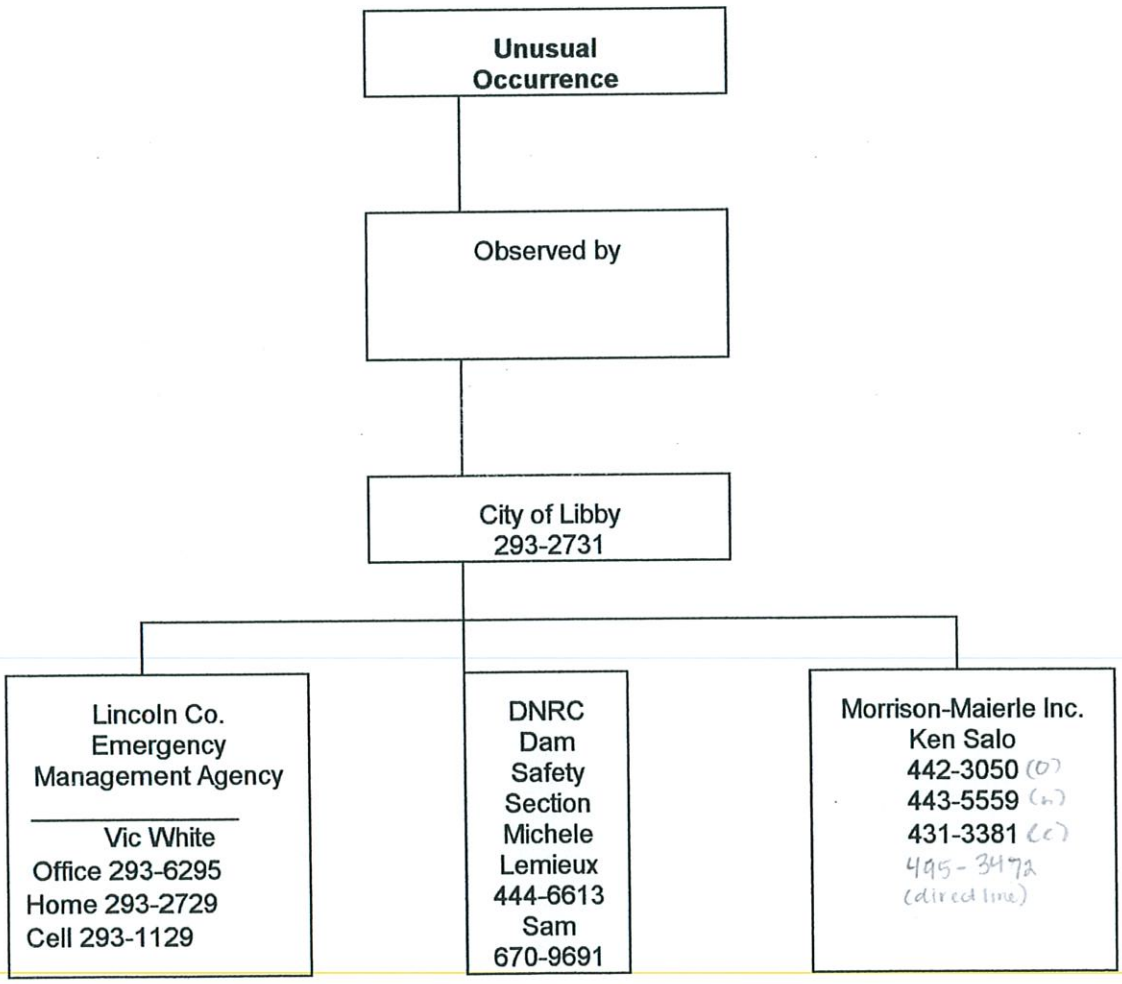


Sam Johnson
Regional Engineer
Office 247-4423
Cell 670-9691
Hm. 896-0371

Mark Pitman
Regional Engineer
(O)
(h)
(c)

info. for Sam is correct

FIGURE 3: UNUSUAL OCCURRENCE NOTIFICATION FLOWCHART



	Sam 247-4423 670-9691	

2.4 What the Dam Owner Should Do

If you discover an unusual condition of the dam embankment that could threaten the structure:

A. Have a qualified engineer inspect the dam to determine whether emergency action is necessary.

B. Notify the county Emergency Management Agency Director of the potential problem.

C. Contact the Department of Natural Resources and Conservation (DNRC) Dam Safety Section.

2.5 Conditions to Watch For

Among the conditions you should watch for are:

A. Overtopping of the dam by flood waters.

B. Failure of outlets or spillways due to clogging or erosion.

C. Movement of the dam on its foundation as evidenced by misalignment, settlement, or cracking.

D. Loss of abutment support as evidenced by cracking in concrete dam.

2.6 Required Data Forms

When you call either an engineer or the DNRC to report a problem, use the form in Appendix A to ensure that you can provide sufficient information for the engineer to analyze the problem. In addition, prepare a sketch showing the extent of the problem. Revise the sketch periodically if the problem develops further. Section 3.0 includes further guidelines for courses of action to take to mitigate the effect of common problems.

2.7 Posting the Notification Flowchart and Distribution of EAP

The notification flowchart is posted and a copy of the EAP is at the City of Libby office in Libby. The Lincoln County Sheriff's Office and Lincoln County EMA Director also have copies of the plan.

2.8 Telephone Directory

2.8.1 First Priority

A. SHERIFF
Lincoln County ..... 911 or 293-4112 ext. 0

B. EMERGENCY MANAGEMENT AGENCY
Lincoln County Office 293-6295

Montana Disaster and Emergency Services
Division (Helena) 841-3911

C. CITY OF LIBBY
City Office 293-2731

2.8.2 Second Priority

A. MONTANA DEPT. OF NATURAL RESOURCES AND CONSERVATION (DNRC)
Dam Safety Section Office: 444-6613 Sam Johnson Office: 247-4423
Michele Lemieux Home: 896-0371
Cell: 459-3572 Cell: 670-9691

B. MORRISON-MAIERLE INC.
Ken Salo ..... Office 442-3050
..... Home 443-5559
..... Cell 431-3381

C. NATIONAL WEATHER SERVICE
Missoula 329-4840 1-800-676-6975

D. MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
Kalispell 752-5501

2.9 Evacuation Procedures

The areas requiring evacuation are shown on the dam break flood inundation mapping included in Appendix B. This inundation is based upon a clear weather dam break (dam break not occurring during a major flood event). The dam break flooding will travel quickly with speeds up to 15 miles per hour and depths ranging from 3 to 12 feet.

When failure is imminent or has occurred, evacuees should be instructed to proceed directly to high ground and to avoid the Flower Creek valley. Because of the quickness and depth of the dam break, there is a tremendous threat to life. Therefore, the most important consideration is to get people to a safe location. Possessions, livestock, etc should be left behind.

When an unusual occurrence has developed, the need for evacuation and the urgency of evacuation should be based on the seriousness of the problem. If deemed appropriate, a slower evacuation using normal access routes may be used.

2.10 Example Emergency Broadcast System Announcement

Example when Flower Creek Dam failure is imminent or has occurred:

ATTENTION: THIS IS AN EMERGENCY MESSAGE FROM THE _____ DEPARTMENT. LISTEN CAREFULLY. YOUR LIFE MAY DEPEND ON IMMEDIATE ACTION. FLOWER CREEK DAM HAS FAILED. REPEAT: FLOWER CREEK DAM HAS FAILED. IF YOU LIVE IN OR NEAR THE FLOWER CREEK VALLEY PROCEED IMMEDIATELY TO HIGH GROUND AWAY FROM THE STREAM VALLEY. DO NOT TRAVEL IN THE STREAM VALLEY OR RETURN TO THE STREAM VALLEY FOR POSSESSIONS. YOU CANNOT OUTRUN OR DRIVE AWAY FROM THE FLOOD WAVE. PROCEED IMMEDIATELY TO HIGH GROUND AWAY FROM THE STREAM VALLEY. (repeat message)

3 MITIGATION ACTIONS

Besides normal monitoring of the dam's condition which is done at least weekly, the owner will provide continuous monitoring and inspection during and after extreme events such as storms and earthquakes. The magnitude of an earthquake or storm can

be obtained from DNRC Dam Safety. Actions suggested to mitigate problems that develop should never be continued at the risk of injury or at the expense of lessening efforts related to evacuation. Monitoring should identify any of the following potential problems.

3.1 Potential Problems and Possible Immediate Response Actions

3.1.1 Overtopping of dam crest by flood waters

A. An extreme flood could exceed the spillway capacities and cause overtopping of the dam crest. The dam structure can withstand a substantial amount of overtopping of overtopping. The project should be closely monitored during the event and following. Should any signs of failure or damage appear, an appropriate evaluation should be initiated.

3.1.2 Excessive seepage through the dam structure, foundation, or abutments

A. Lower the water level until the flow decreases to a non-erosive velocity or until it stops.

3.1.3 Failure of appurtenant structures such as outlets or spillways

A. Implement temporary measures to protect the damaged structure, such as closing an outlet or providing temporary protection for a damaged spillway.

B. Lower the water level to a safe elevation. If the outlet is inoperable, then pumping, siphoning, or a controlled breach may be required.

3.1.4 Mass movement of the dam on its foundation

A. Immediately lower the water level until excessive movement stops.

3.1.5 Excessive seepage and highlevel saturation of the concrete

A. Lower the water to a safe level.

B. Continue frequent monitoring for signs of cracking or concentrated seepage.

3.1.6 Spillway back cutting threatening reservoir evacuation

A. Reduce the flow over the spillway by fully opening the main outlet.

B. When the inflow subsides, lower the water to a safe level.

3.1.7 Earthquake Zone

Flower Creek Dam is located in an area subject to earthquakes of moderate (zone 2) damaging intensity.

If you have felt an earthquake or one has been reported to have occurred in the area with a Richter magnitude of 4.0 or greater within a 30 miles radius, 5.5 or greater within 90 miles, or 6.5 or greater within a 180 mile radius from the site, then follow the following procedures:

A. Immediately conduct a general overall visual inspection of the dam.

B. Perform field inspection and field survey as required to check for movement of the dam structure.

C. Drain Reservoir as required.

3.2 Emergency Supplies and Resources

Soils and rock suitable for emergency repairs are available in the vicinity of Flower Creek Dam. Any materials taken from property not owned by the City of Libby would require the property owners permission. If it is necessary to repair concrete on the dam, the services of reputable General Contractor would be required to perform this work. A list of contractors in the Libby area are included below.

3.3 Local Contractors

Noble Excavating ……293-8824

Thompson Contracting……293-5323

Oedewaldt Construction Inc……293-5326

J.L. Regh	293-6020
Marion Orr Excavating	293-4702
Remp Sand and Gravel	293-5573
Lincoln County Road Department	293-4557
Montana Department of Transportation Maintenance Shop	293-7921

APPENDICES

APPENDIX A - DAM INCIDENT REPORT FORM
APPENDIX B - INUNDATION AND EVACUATION MAPS
APPENDIX C - TECHNICAL DATA FOR FLOWER CREEK DAM
APPENDIX D - PROJECT PHOTOGRAPHS

APPENDIX A
DAM INCIDENT REPORT FORM

DAM INCIDENT REPORT FORM

DATE:_____ TIME:_____

NAME OF DAM: Flower Creek Dam MT - 1458

STREAM: Flower Creek

LOCATION: Section 21, Township 30 North, Range 31 West

COUNTY: Lincoln

OBSERVER:_____

OBSERVER TELEPHONE:_____

NATURE OF PROBLEM:_____

_____

LOCATION OF PROBLEM AREA (Looking Downstream):_____

_____

EXTENT OF PROBLEM AREA:_____

_____

FLOW QUANTITY AND COLOR:_____

_____

WATER LEVEL IN RESERVOIR:_____

WAS SITUATION WORSENING?_____

EMERGENCY STATUS:_____

CURRENT WEATHER CONDITIONS:_____

_____

ADDITIONAL COMMENTS:_____

_____

_____

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DATE:_____ TIME:_____

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_____

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EXTENT OF PROBLEM AREA:_____

_____

FLOW QUANTITY AND COLOR:_____

_____

WATER LEVEL IN RESERVOIR:_____

WAS SITUATION WORSENING?_____

EMERGENCY STATUS:_____

CURRENT WEATHER CONDITIONS:_____

_____

ADDITIONAL COMMENTS:_____

_____

_____

RESERVOIR:

Maximum Reservoir Capacity at Crest of the Dam: 285 acre-ft
Normal Reservoir Capacity at crest of spillway: 221 acre-ft

DAM:

Normal Reservoir Surface Area: 11.8 acres;
Dam Type: Concrete Arch variable radius;
Dam Height: 58.6 ft;
Dam Crest Width: 3.5 ft;
Dam Crest Elevation: 58.6 (Project Datum, stream bottom elevation 0.0);
Dam Width at Base: 9.0 ft;
Length of Dam: 117.8 ft (Excluding Spillways);
Outlet Types: 1-10" diameter Cast Iron gate valve controlled, 1-12" diameter Cast Iron gate valve controlled;
Outlet Capacity: 35 cfs at full pool, Center Line Elevation: 11.5 feet (project datum);
Diversion Opening: 3 Foot Square, sluice-gated concrete opening through dam;
Diversion Capacity: 300 cfs at full pool, Invert Elevation: 5.0 feet (project datum);

Spillway Capacity:
North Spillway: Concrete chute with broad crested weir control;
Crest Length: 30.2 feet;
Crest Breadth: 3.5 feet;
Crest Elevation: 50.0 feet (project datum);
Capacity: 915 cfs at water surface elevation 55.0 (project datum);

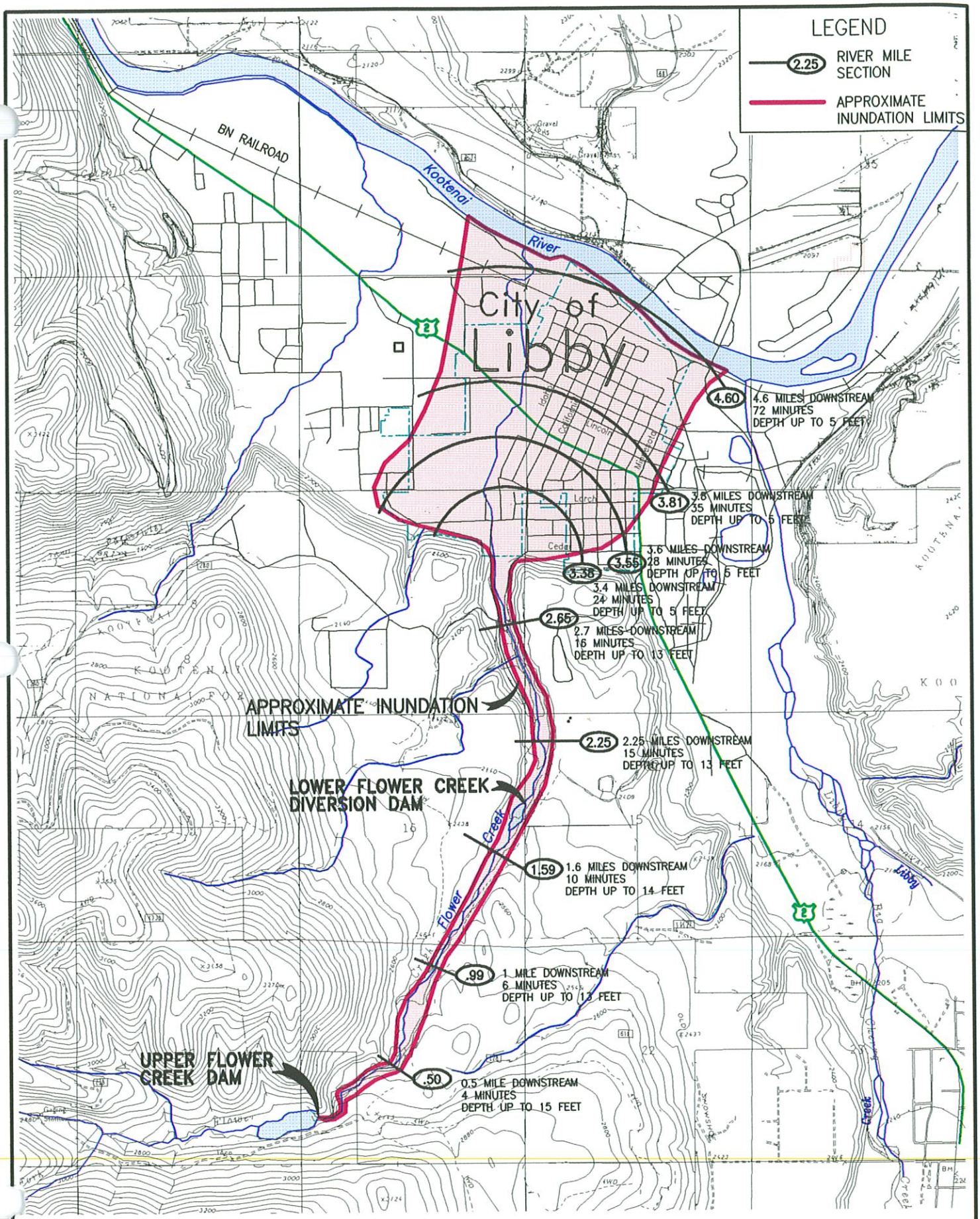
South Spillway: Concrete chute with broad crested weir control;
Crest Length: 32 feet including 1 foot center pier and wing wall;
Crest Breadth: 3.5 feet;
Crest Elevation: 50.4 feet (project datum);
Capacity: 875 cfs at water surface elevation 55.0 (project datum);

Dam History:

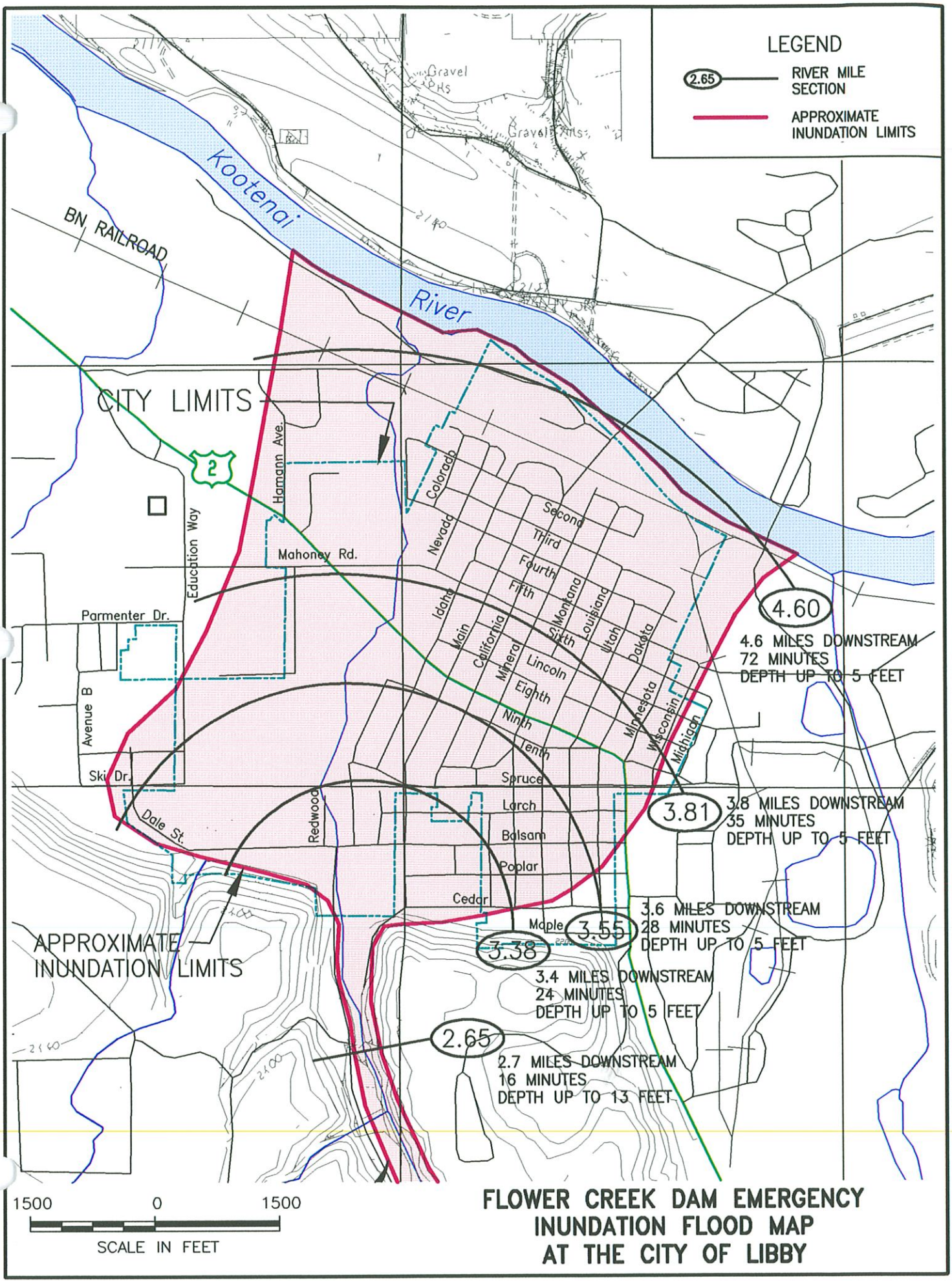
Date Constructed: 1945-1946;
Owner at time of Construction: Pacific Power and Light;

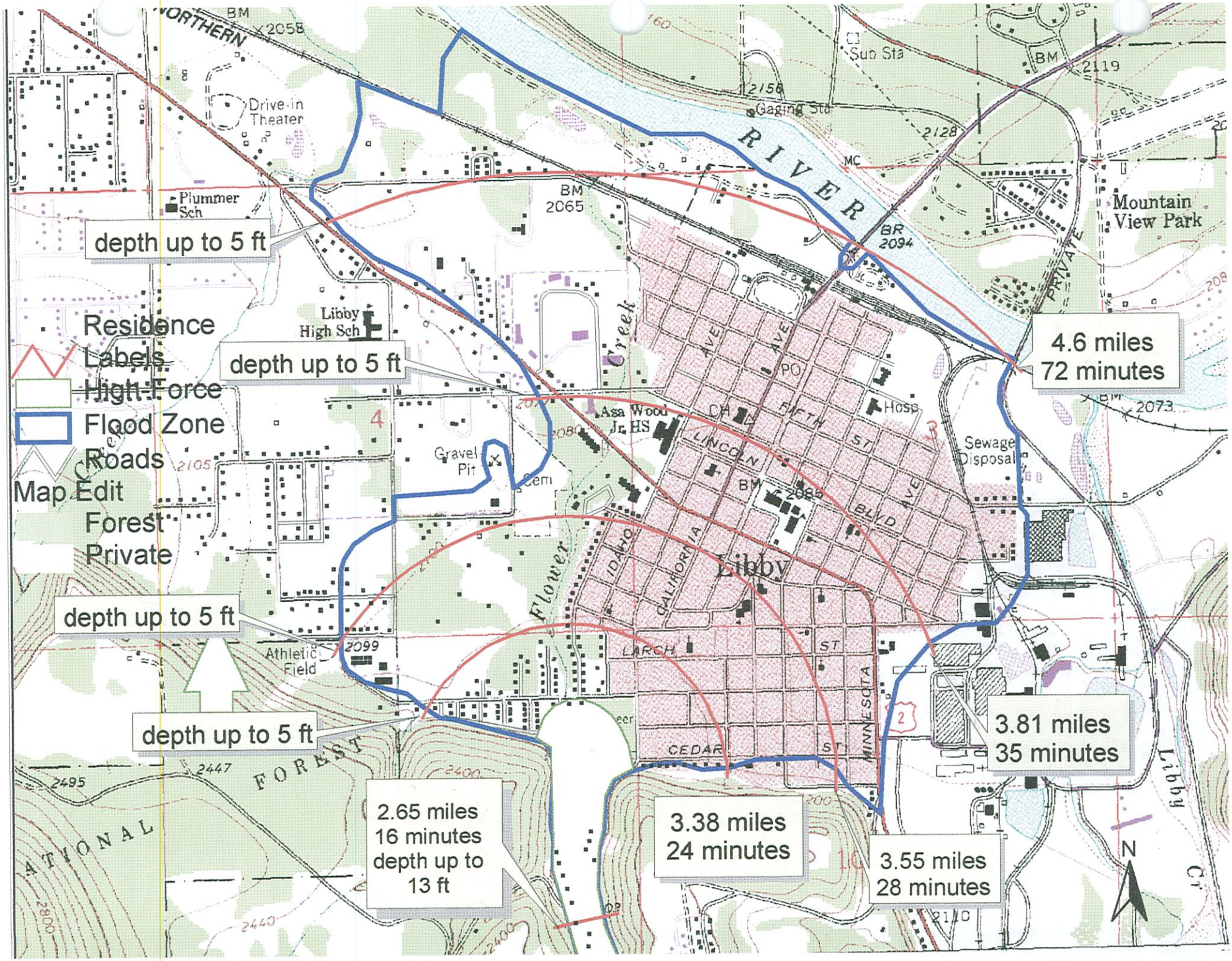
APPENDIX B
INUNDATION AND EVACUATION MAPS

INDEX AND INUNDATION AND EVACUATION MAPS HERE



FLOWER CREEK DAM EMERGENCY INUNDATION FLOOD MAP


LEGEND
2.65
RIVER MILE SECTION
APPROXIMATE INUNDATION LIMITS
Kootenai River
BN RAILROAD
CITY LIMITS
Hamann Ave.
Education Way
Mahoney Rd.
Parmenter Dr.
Avenue B
Ski Dr.
Dale St.
Redwood
Colorado
Nevada
Second
Third
Fourth
Fifth
Sixth
Idaho
Main
California
Mineral
Lincoln
Eighth
Ninth
Tenth
Montana
Louisiana
Utah
Dakota
Minnesota
Wisconsin
Michigan
Spruce
Larch
Balsam
Poplar
Cedar
Maple
4.60
4.6 MILES DOWNSTREAM
72 MINUTES
DEPTH UP TO 5 FEET
3.81
3.8 MILES DOWNSTREAM
35 MINUTES
DEPTH UP TO 5 FEET
3.55
3.6 MILES DOWNSTREAM
28 MINUTES
DEPTH UP TO 5 FEET
3.38
3.4 MILES DOWNSTREAM
24 MINUTES
DEPTH UP TO 5 FEET
2.65
2.7 MILES DOWNSTREAM
16 MINUTES
DEPTH UP TO 13 FEET
APPROXIMATE INUNDATION LIMITS
1500 0 1500
SCALE IN FEET
FLOWER CREEK DAM EMERGENCY INUNDATION FLOOD MAP AT THE CITY OF LIBBY


depth up to 5 ft
depth up to 5 ft
depth up to 5 ft
depth up to 5 ft
Residence
Labels
High Force
Flood Zone
Roads
Map Edit
Forest
Private
4.6 miles
72 minutes
3.81 miles
35 minutes
3.55 miles
28 minutes
3.38 miles
24 minutes
2.65 miles
16 minutes
depth up to
13 ft
RIVER
Libby
Flower Creek
Libby Cr
Mountain View Park
Drive-in Theater
Plummer Sch
Libby High Sch
Asa Wood Jr. HS
Gravel Pit
Sewage Disposal
Athletic Field
Sub Sta
Gaging Sta
Hosp
PO
CH
FIFTH ST
LINCOLN BLVD
LARCH ST
CEDAR ST
MINNESOTA AVE
IDAHO AVE
CALIFORNIA AVE
FOREST
BM 2058
BM 2065
BM 2119
BM 2073
BM 2084
BR 2094
MC
PRIVATE
N

APPENDIX C
TECHNICAL DATA FOR FLOWER CREEK DAM

RESERVOIR:

Maximum Reservoir Capacity at Crest of the Dam: 285 acre-ft
Normal Reservoir Capacity at crest of spillway: 221 acre-ft

DAM:

Normal Reservoir Surface Area: 11.8 acres;
Dam Type: Concrete Arch variable radius;
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Dam Crest Elevation: 58.6 (Project Datum, stream bottom elevation 0.0);
Dam Width at Base: 9.0 ft;
Length of Dam: 117.8 ft (Excluding Spillways);
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Outlet Capacity: 35 cfs at full pool, Center Line Elevation: 11.5 feet (project datum);
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Capacity: 875 cfs at water surface elevation 55.0 (project datum);

Dam History:

Date Constructed: 1945-1946;
Owner at time of Construction: Pacific Power and Light;

APPENDIX D
PROJECT PHOTOGRAPHS

PROJECT PHOTOGRAPHS
PRIOR TO REHABILITATION CONSTRUCTION

FLOWER CREEK DAM
LIBBY, MONTANA

Original wood constructed valve house building located at the base of the dam.

FLOWER CREEK DAM
LIBBY, MONTANA

Original wood constructed access bridge across the south spillway with chain link safety fence.

FLOWER CREEK DAM
LIBBY, MONTANA

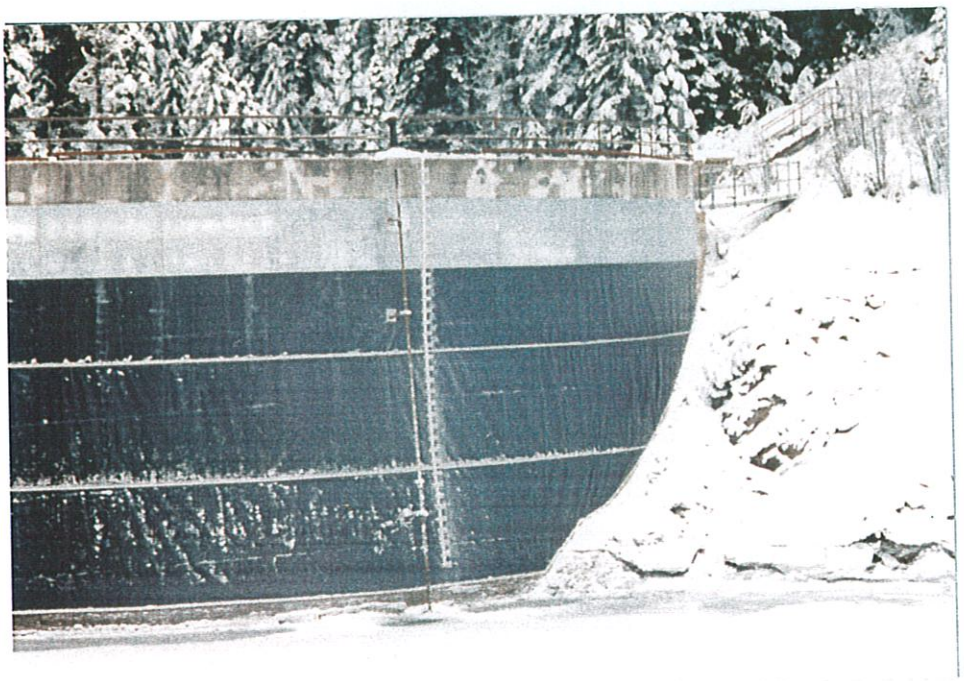
Original wood constructed access bridge across the south spillway and original concrete at right (looking upstream) spillway chute wall.

FLOWER CREEK DAM
LIBBY, MONTANA

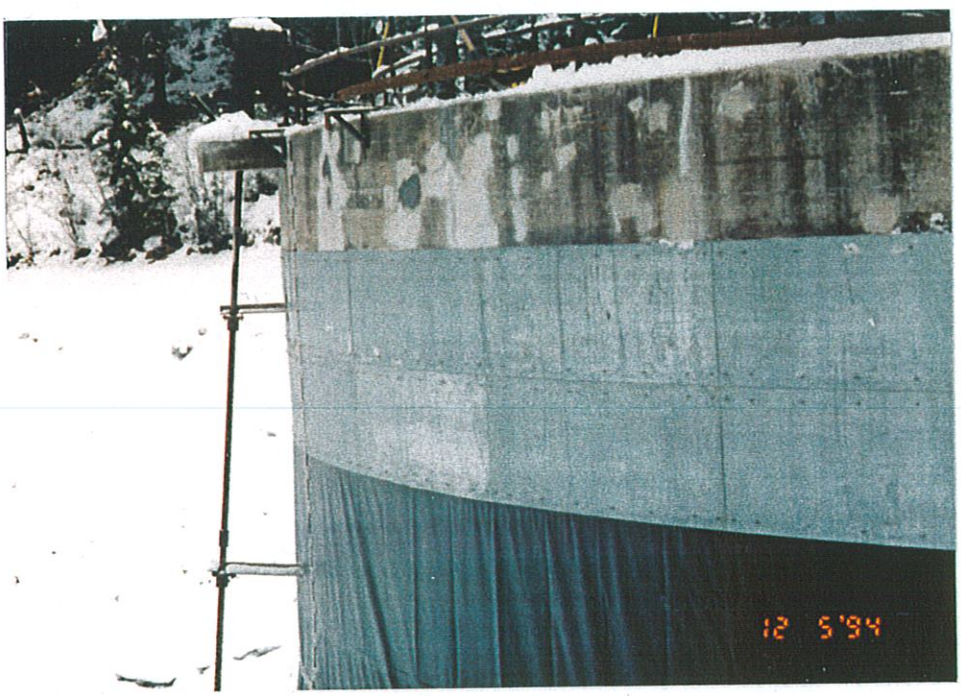
Original wood constructed valve house building with wood plank access bridge.

PROJECT PHOTOGRAPHS
AFTER REHABILITATION CONSTRUCTION

FLOWER CREEK DAM
LIBBY, MONTANA



Hypalon membrane liner on upstream dam face.

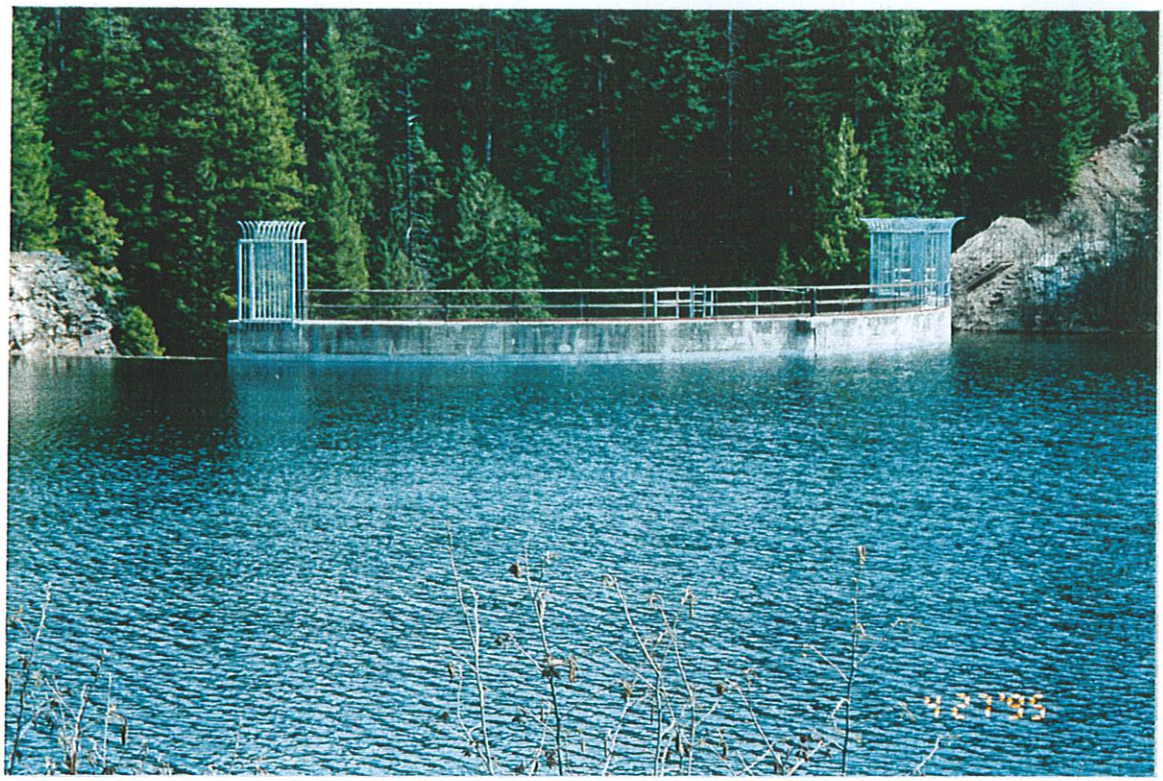


Close up of six foot high steel band on the top edge of membrane liner.

FLOWER CREEK DAM
LIBBY, MONTANA

Downstream face of the dam with new reinforced concrete valve house structural steel access platforms and ladder.

FLOWER CREEK DAM
LIBBY, MONTANA



Upstream face of the dam with new structural steel safety cages adjacent to the south (left) spillway and over the north (right) spillway.

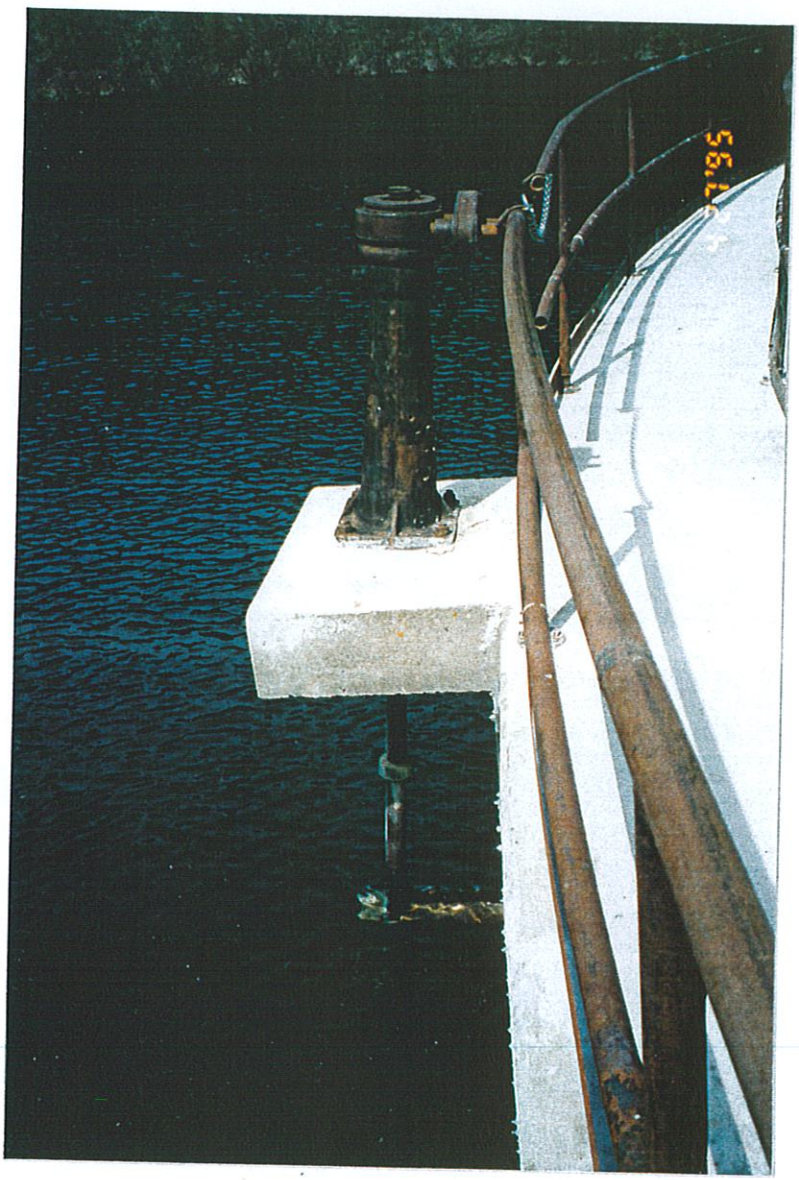
FLOWER CREEK DAM
LIBBY, MONTANA

South spillway chute with new structural steel access bridge and safety cage and rehabilitated reinforced concrete at right (looking upstream) chute wall.

FLOWER CREEK DAM
LIBBY, MONTANA

New structural steel access bridge and steel bar cage across the south spillway.

FLOWER CREEK DAM
LIBBY, MONTANA



Slide gate control operator for three foot square diversion opening.